

J Abnorm Child Psychol (2010) 38:485–495
DOI 10.1007/s10802-009-9379-0

Toddlers' Temperament Profiles: Stability and Relations to Negative and Positive Parenting

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Published online: 8 January 2010

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Abstract This study investigated the type and stability of temperament profiles in toddlers, and relations of profile probability to negative and positive parenting trajectories. Mothers ($N=96$) rated their child's (41 girls and 54 boys) Sociability, Anger Proneness, and Activity Level four times during 1 year. The assessment of parenting included both maternal self-reports and observational measures. Latent profile analysis indicated three child temperament profiles: a well-adjusted 'typical' profile, an 'expressive' profile with heightened externalizing problems, and a 'fearful' profile with heightened internalizing problems. Although toddlers' profile classifications were highly stable across 1 year, individual differences in (changes in) toddlers' temperament profile probability occurred. We identified negative and positive parenting as environmental mechanisms that were related to the development of temperament profiles over time. These results support the notion that, in addition to having a genetic base, temperament is subject to maturation and experience over time.

Keywords Temperament profile · Adjustment · Parenting · Longitudinal · Latent profile analysis

Introduction

Temperament can be defined as the biologically based core of individual differences in style of approach and response to the environment that is stable across time and situations. This core is then thought to become more differentiated into later personality through interaction with the environment (Shiner and Caspi 2003). Most research on child temperament has investigated temperament traits, representing a variable-centered approach. Several different temperament taxonomies co-exist, describing temperament along different dimensions or traits. Early on, Chess and Thomas (1985) described nine dimensions: activity level, rhythmicity, approach, adaptability, responsiveness, intensity of reaction, quality of mood, distractibility and persistence. Other theorists have mostly employed a three dimensional framework. Buss and Plomin (1984) identified emotionality, activity, and sociability, and Goldsmith (1996) used the dimensions of anger proneness, social fear and activity level to describe temperament. Although Rothbart (1981) had initially proposed more dimensions, Gartstein and Rothbart (2003) also came to a three dimensional taxonomy based on factor-analytic results, including surgency, negative affectivity and a regulatory component of temperament, effortful control.

Although temperament may be described by relatively independent dimensions derived from factor analysis, not all possible combinations of these dimensions may occur in actual persons. Even if they all occur, certain combinations could be much more likely in that they characterize more individual children. In a person-centred approach the configuration of temperament traits within individuals is investigated. Temperament theory has advocated a person-centred approach from its beginning. Thomas and Chess's temperament theory (1985), in addition to describing several temperament dimensions, classified children as

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belonging to three types: ‘easy’, ‘slow to warm up’, or ‘difficult’. The person-centred approach is also in line with contemporary ‘systems’ approaches to development, which indicate that through interaction of the separate temperament dimensions, or lower order elements, the whole personality organization emerges within the individual (Lewis 2000).

A handful of studies have taken a person-centred approach to temperament in preschool-aged children. Aksan and colleagues (1999) found two temperament types: one high in control and low in both approach and negative affectivity, and one low in control and high in approach and negative affectivity. There was also a large ‘other’ group, but classification of all individuals into types was not attempted. Komsí and colleagues (2006) found that temperament clustered into three types: a ‘resilient’ type, characterized by high activity, positive affectivity and control and low negative affectivity; an ‘undercontrolled’ type, characterized by high activity and negative affectivity, and low control and positive affectivity; and an ‘over-controlled’ type, characterized by low activity and positive affectivity, average negative affectivity and high control. Stifter et al. (2008) also revealed three clusters: an ‘inhibited’ cluster, high in negative affect and low in approach; an ‘exuberant’ cluster, high in positive affect and high on approach; and a ‘low reactive’ cluster, moderate on approach and low on positive and negative affect.

Although the aforementioned studies converged on a three profile solution, two studies investigating temperament found a five-type solution to be the best fitting one. Caspi and Silva (1995) found an ‘undercontrolled’ type, characterized by a lack of control and difficulty sustaining attention; an ‘inhibited’ type, that also had difficulty sustaining attention but was also socially inhibited; a ‘reserved’ type, that was also inhibited but not as much and had no difficulty sustaining attention; a ‘confident’ type that was mainly characterized by high scores on approach; and finally, a ‘well-adjusted’ type that was average on all measures. More recently, Janson and Mathiesen (2008) also converged on a five type solution. The undercontrolled, confident and inhibited types were replicated, but they found an ‘unremarkable’ type rather than a ‘well-adjusted’ type that was characterized by average to moderately low scores on all temperament dimensions, and an ‘uneasy’ type that was shy and high on emotionality.

The discrepancies in the number and content of temperament types may be due to the analysis techniques used in previous studies, such as cluster analysis and configural frequency analysis. In the present study, we performed latent profile analysis (LPA) (Muthén and Muthén 2000). Unlike cluster analysis, LPA allows for varying parameters across the profiles, and provides

statistics that help the researcher make a more objective choice for a final model. Furthermore, whereas in traditional clustering techniques individuals are assigned to clusters on an all-or-none basis, LPA provides a probability score for each profile, thereby taking uncertainty of membership, or error, into account. Individuals can be assigned to the profile for which they have the highest probability, and additionally, the probabilities themselves can be investigated. Although we are unaware of any studies employing LPA for preschool aged children’s temperament, we know of one study that used it to investigate older children. Rettew et al. (2008) found that 11 year old children were best categorized into three profiles: a ‘disengaged’ profile, characterized by high novelty seeking, low persistence and reward dependence, a ‘steady’ profile, which was non-impulsive, orderly and characterized by a strong ability to persevere despite obstacles or frustration, and a ‘moderate’ profile, characterized by moderate scores on all temperament dimensions.

Temperament is implicated in adjustment problems. Certain temperament characteristics may make children vulnerable to developing internalizing or externalizing problems. Recently, high negative emotionality and activity as assessed by different temperament measures have been shown to be related to externalizing problems, whereas low sociability was related to internalizing problems (De Pauw et al. 2009). A few studies have related temperament clusters in preschool aged children to adjustment problems, and found that one or two clusters had both elevated levels of internalizing and externalizing problems (Aksan et al. 1999; Janson and Mathiesen 2008; Rettew et al. 2008; Stifter et al. 2008). Relating temperament profiles to adjustment problems may help validate the profiles by showing that they are meaningfully related to other aspects of development. Furthermore, some children may be especially prone to internalizing problems, whereas others are prone to externalizing problems, due to their configuration of temperament traits. The first aim of the present study was to investigate, using LPA, whether toddlers’ temperaments are best described by a three- or a five profile solution, and whether these profiles can be distinguished by their levels of adjustment problems.

Temperament Profile Stability

The second aim of the present study was to investigate temperament profile stability. Temperament is (theoretically) regarded as a heritable, biologically based core that is highly stable across time and situations. Early temperament traits indeed predict later childhood temperament (Komsí et al. 2006; Putnam et al. 2008), and even adult personality (Blatny et al. 2007), providing evidence for the stability of temperament traits. However, temperament is thought to be

influenced not only by heredity, but also by maturation and experience, and is thus regarded as developing (Rothbart and Bates 2006). For instance, the earlier children develop fearful inhibition, the earlier they are motivated to avoid potentially threatening situations and the fewer experiences of these situations they will have. This difference in experience may in turn impact the development of fearful inhibition itself. Indeed, behavioral genetic studies find, next to significant heritability, a significant contribution of environmental factors (Goldsmith et al. 1999).

Supporting the idea of temperament as developing, a meta-analysis of temperament and personality development has indicated that stability is only moderate overall, with test-retest correlations ranging from 0.35 in the 0–3 year age range, to 0.52 in the 3–6 year age range (Roberts and DelVecchio 2000). To our knowledge only two studies investigated stability in temperamental profiles during the childhood years. Aksan and colleagues (1999) found a fair to moderate degree of stability for their two types from 3.5 to 4.5 years of age, with fewer than 50% of children remaining in the same category. Janson and Mathiesen (2008) report similar stability coefficients, with 46% of children remaining in the same temperament profile over a 2-year timespan, from 2.5 to 4.5 years. In general, toddlerhood is characterized by rapid development of emotion regulatory capacity, patterns of relating to others, and internal representations of relationships. When development is rapid, shorter spaced assessments are needed to pick up on developmental changes which may be lost over longer timescales. Generally, it is important to supplement investigations on larger timescales with investigations on smaller timescales to get a fuller picture of the nature of temperament development across the lifespan. In contrast to previous studies on the stability of temperament profile membership, the present study takes a more fine-grained look by investigating toddlers over a 1 year period, across four time points.

Even when stability is high, individual differences in this stability may occur, with environmental mechanisms contributing to these differences. One such mechanism is parenting. Negative parenting behaviors, such as hostility, harshness and negative control, can be distinguished from positive parenting behaviors, such as support, consistency and sensitivity. Children with an ‘easy’ temperament may elicit more positive parenting than children with a ‘difficult’ temperament, whereas children with a difficult temperament may be challenging to handle and elicit more negative parenting than their easy counterparts. Child negative emotionality is indeed associated with less supportive parenting and more restrictive control (Paulussen-Hoogeboom et al. 2007), and mothers of irritable and fearful toddlers have been shown to be more disapproving (Gauvain and Fagot 1995). Increases in negative emotionality between 4 and 12 months have been

related to more negative parenting when toddlers were 18 months (Bridgett et al. 2009).

Experiences of parenting may in turn promote stability in these temperament profiles. For instance, toddler inhibition is related to later social reticence, only when mothers use intrusive control (Rubin et al. 2002). In the present study we included multiple measurements of temperament as well as parenting, allowing us to investigate the stability of profile membership and relations of profile membership probability to trajectories of negative and positive parenting.

Present Study

In the present study, we employed LPA to investigate the number and types of profiles that best describe the present sample. Based on previous research, we hypothesized that either a three-profile (Aksan et al. 1999; Komsí et al. 2006; Stifter et al. 2008) or a five-profile solution (Caspi and Silva 1995; Janson and Mathiesen 2008) would emerge. We expected that a well-adjusted profile would emerge, as well as one or more profiles with heightened levels of internalizing or externalizing problems. We further expected that profile membership would be moderately stable, and that well-adjusted temperament profiles would be longitudinally related to trajectories of more positive and less negative parenting, whereas less adaptive temperament profiles would be related to trajectories of less positive and more negative parenting. A multi-informant approach, including observer and mother reports allowed for the reduction of reporter bias in the assessment of parenting.

Method

Participants and Procedures

The sample consisted of 96 mothers and their children (41 girls and 54 boys). The children’s mean age was 30 months at T1 ($SD=6.5$, range=18–43), 36 months at T2 ($SD=6.5$, range=26–49), 39 months at T3 ($SD=6.5$, range=27–51), and 42 months at T4 ($SD=6.5$, range=40–55 months). The mothers’ mean age was 34.7 years at T1 ($SD=4.9$, range=23–46). 98% had Dutch nationality, 90% were two-parent families, and 10% were single mothers. Percentages of mothers’ educational levels were 4% for elementary school, 11% for secondary school, 79% for non-university higher education, and 6% for university or higher. Ten % of the families were of low socioeconomic status (SES) (<€1,400 per month), 47% of intermediate SES (€1,400–€2,800 per month), and 43% of high SES (>€2,800 per month).

Approximately 1,000 mothers, recruited through Infant Health Care centres, were asked to provide contact

information if they wished to be informed about our study and 227 mothers provided contact information. Because of the time-consuming nature of the study, a random subgroup of 150 mothers was selected to be contacted, and recruitment stopped when 99 mothers had agreed to participate. Three mothers did not fill out the questionnaires, leaving a total of 96 participants. Three mothers dropped out of the study between the first and the second time point, and one more mother dropped out between the third and the fourth time point. Participants and non-participants did not differ on demographic variables or on the variables under study. As Little's MCAR test indicated that data was missing completely at random, $\chi^2(33)=40.94$, $p=0.16$, it could be imputed using Expectation Maximization (Schafer and Graham 2002).

After parents gave informed consent, the research staff made four home visits over the course of 1 year, each lasting about 45 min. The home visits included a 12-min., standardized and video-taped observation of mother-child play interactions. A box of Lego blocks with two little cars were offered on a carpet of approximately 1 m². The mother-child dyads performed four subtasks: free play (2 min), building a tower (4 min), building a bridge (3 min) and cleaning up (3 min). Mothers were asked to play with their child as they usually would. Home visits were carried out by a staff member and five trained research assistants, who were master students participating in the project as part of their Master thesis. Immediately after the home visit, the staff member or assistant that made the visit coded the Coder Impressions Inventory (CII) (Webster-Stratton 1998). The video tapes were later coded by a staff member and two trained research assistants. All coding was conducted independently and blind to temperament status. At each assessment time, questionnaires were sent to the mothers.

Measures

Temperament Mothers rated the activity level, anger proneness, and social fearfulness scales of the short version of the Toddler Behavior Assessment Questionnaire (TBAQ) (Goldsmith et al. 1991), which was specifically devised for children in the age range of this study. Items are rated on scales ranging from 1(*never*) to 7(*always*). The social fearfulness scale consists of 11 items measuring inhibition, distress, or signs of shyness in novel or uncertainty-provoking situations of a social nature (e.g., 'when at the doctor's office, how often did your child cry or struggle when the doctor tried to touch him/her?'). The anger proneness scale consists of nine items measuring crying, protesting, or other signs of anger in situations involving conflict with another child or the caregiver (e.g., 'when it was time for bed or a nap and your child did not want to go,

how often did s/he physically resist or struggle?'). However, as missing data for one of the items ('when you were going out and your child did not want to stay with the regular sitter, how often did s/he show no signs of anger?') ranged from $n=51$ (T4) to $n=63$ (T2) and this item had a strong negative influence on the scale reliability, it was excluded from subsequent analyses. The activity level subscale consists of seven items measuring limb, trunk or locomotor movement during a variety of daily situations (e.g., 'when being dressed, how often did your child squirm or try to get away?'). Cronbach's *alphas* for the present sample ranged from 0.59 to 0.70, with two exceptions: Cronbach's *alphas* for activity level at T1 and T2 were 0.42 and 0.56 respectively. These reliabilities are comparable to those of other studies on temperament in this age range (Janson and Mathiesen 2008).

Adjustment problems Mothers rated the internalizing and externalizing problem behavior subscales of the Dutch version of the Child Behavior Check List (CBCL/ 2–3) (Achenbach 1992). The internalizing subscale consists of 25 items (e.g., 'My child cries a lot'), whereas the externalizing subscale consists of 26 items (e.g., 'My child disobeys'). Each item is rated: 0(*not true*), 1(*sometimes/somewhat true*), or 2(*often/very true*). The CBCL is a well validated, reliable instrument to measure child behavior (Vignoe et al. 2000). Cronbach's *alphas* for the present sample ranged from 0.72 to 0.90.

Parenting The negative parenting measure comprised the *harshness* scale from the Coder Impressions Inventory (Webster-Stratton 1998), the *hostility* scale from the Erickson rating scales (Erickson et al. 1985), and the *negative control* dimension from the Parenting Dimensions Inventory (PDI) (Slater and Power 1987). The harshness scale of the CII consists of 12 items (e.g., 'The parent used sarcasm in a demeaning or hurtful way'). The CII was originally designed for treatment effectiveness studies. Coders rate how often the observed parenting behaviors occurred, 1(*did not occur*), 2(*occurred once*), or 3(*occurred more than once*). Coders achieved agreement of >80% after 30 h. of training with videotapes before home visits. Cronbach's *alphas* for the harshness scale ranged from 0.67 to 0.80. Three different observers rated the Erickson scales for the videotapes of the home observations, after 25 h of practice. These 7-point rating scales are regularly used to code parents' interactions with children in the present age range (e.g., Alink et al. 2009; van Bakel and Riksen-Walraven 2002). The hostility scale measures mothers' expressions of anger and rejection of the child. For this scale, the intra-class correlation between raters in a subsample of 25 tapes was ICC=0.70. In addition to these observational measures, mothers rated their negative con-

trol on six hypothetical situations from the PDI, describing child misbehavior (i.e., “Your child hits his/her friend after an argument”), each followed by several parental reactions. Mothers indicated how probable it was that they would use each reaction (0=*very improbable* to 3=*very probable*). A mean score across situations was calculated for: ignoring, love withdrawal, physical punishment, and exercise of power. Cronbach’s *alphas* for negative control ranged from 0.83 to 0.89. Results of confirmatory factor analysis (CFA) for the measures of negative parenting affirmed the feasibility of combining reports. When a single component was extracted, it had an eigenvalue of 1.54, explaining 51% of the variance, and all factor loadings were greater than 0.61. Scores on the indicators were first standardized and then averaged to form composite scores (scores were standardized across rather than within time points, thereby preserving the relative differences in variability across time allowing for the investigation of change across time).

The positive parenting measure included the *support* scale from the CII, the Erickson *sensitivity* scale, the *consistency* scale of the PDI, and the *responsiveness* scale of the Nijmegen Parenting Questionnaire (NPQ) (Gerris et al. 1993). Observers coded the support scale of the CII, which consists of 13 items (e.g., ‘mother was patient with the child’), coded as 1(*did not occur*), 2(*occurred once*), or 3(*occurred more than once*). Cronbach’s *alphas* for the support scale ranged from 0.71 to 0.86. Additionally, observers coded the Erickson sensitivity scale on a 7-point scale, reflecting the extent to which the mother remains engaged, responds to her child’s needs, and paces her efforts to her child’s tempo. The intra-class correlation between raters in a subsample of 25 tapes was ICC=0.88. Finally, mothers rated their responsiveness and consistency. The consistency scale of the PDI consists of eight items (e.g., ‘My child often gets me to change my mind after I have denied his/her request’), rated on a six point scale (1=*completely disagree* to 6=*completely agree*). Cronbach’s *alphas* for the consistency scale ranged from 0.71 to 0.77. The responsiveness scale of the NPQ consists of eight items (e.g., ‘I know what’s wrong when my child is having problems’), rated on a 6-point scale (1=*I totally disagree* to 6=*I totally agree*). Cronbach’s *alphas* for the responsiveness scale ranged from 0.79 to 0.91. Results of confirmatory factor analysis (CFA) for the measures of positive parenting affirmed the feasibility of combining reports into a composite score. When a single component was extracted, it had an eigenvalue of 1.44, explaining 36% of the variance, and all factor loadings were greater than 0.45. Scores on the indicators were averaged to form composite scores (scores were first standardized across time points, preserving the relative differences in variability across time).

Statistical Analysis

To ensure that the four time points weighed equally in the profile analysis, while preserving level differences, scores for each of the temperament traits were standardized across time points. In LPA in Mplus version 4.2 (Muthén and Muthén 2007) these standardized scores were regressed on a latent categorical variable representing the profiles ($N=384$). Three-variable temperament measurements were thus regarded as profiles, disregarding whether profiles describe different people at the same time point or the same people at different time points. We assessed model fit with the Lo-Mendell-Rubin (LMR) test, which compares models with a model with $k-1$ profiles (Lo et al. 2001), the sample size adjusted Bayesian Information Criterion (adjBIC), with lower values indicating better fit, and entropy as a measure of classification quality. Most importantly, the profiles were inspected for their substantive interpretation. In addition to a categorical profile classification, continuous probability indicators were obtained for each profile. MANOVAS were performed to investigate the statistical significance of the mean difference between profiles for each temperament trait, as well as differences in levels of adjustment problems. Next, we performed General Loglinear Modeling to investigate profile stability. Finally, we performed Latent Growth Curve Modeling to investigate the relations between temperament profile probability and positive and negative parenting. Multivariate growth models were fitted in LISREL 8.54 (Jöreskog and Sörbom 2003) to the observed mean vector and covariance structure using Maximum Likelihood estimation. Each model included covariances between the intercept and slope of the probability for one of the temperament profiles and the intercept and slope of either positive or negative parenting. Slope loadings of the first and final time point were fixed to one, whereas loadings of the second and third time point were freely estimated to allow for nonlinearity of change. We assessed model fit with the comparative fit index (CFI), with CFI>0.90 indicating a good fit; and the root mean square error of approximation (RMSEA), with RMSEA<0.08 indicating an acceptable fit (for an overview of model fit statistics, see Hu and Bentler 1995).

Results

Profile Analysis

Three-, four-, and five-profile models were fitted to the data. The three-profile model was chosen as providing the best fit to the data (three profile model: Loglikelihood (20)=-1,552.05, LMR=58.84, $p<0.01$, AIC=3,144.10, BIC=3,223.11, entropy=0.71). Although the four- and five-profile models had

lower AIC and BIC indexes, they did not provide statistically significant incremental fit over the k-1 models, whereas the three-profile model did (four profile model: Loglikelihood (18) = -1,550.28, LMR = 20.28, $p < 0.35$, AIC = 3,136.55, BIC = 3,207.67, entropy = 0.74; five profile model: Loglikelihood (22) = -1,539.65, LMR = 20.41, $p < 0.06$, AIC = 3,123.29, BIC = 3,210.21, entropy = 0.72). Furthermore, the three-profile model provided a sufficient classification of individuals: the average probabilities for the most likely profile were large enough (>0.81), and the probabilities for the other two profiles were small enough, (<0.13). Finally, each profile was sufficiently large to allow for the expectation that the results might replicate across samples and are not due to the specific characteristics of a certain individual (profile 1 = 60.9%, profile 2 = 26.6%, profile 3 = 12.5%). For a graphical representation of the estimated profile means, see Fig. 1.

A MANOVA was performed to investigate the statistical significance of the mean difference between profiles for each temperament trait. Descriptives of the study variables are provided in Table 1. The multivariate test revealed a significant main effect for temperament profile, $F(6,760) = 145.64$, $p < 0.01$. The effect size was large, partial $\eta^2 = 0.54$ (Cohen 1988). Univariate tests indicated that there were significant differences of a large effect size between the profiles for each of the temperament traits,

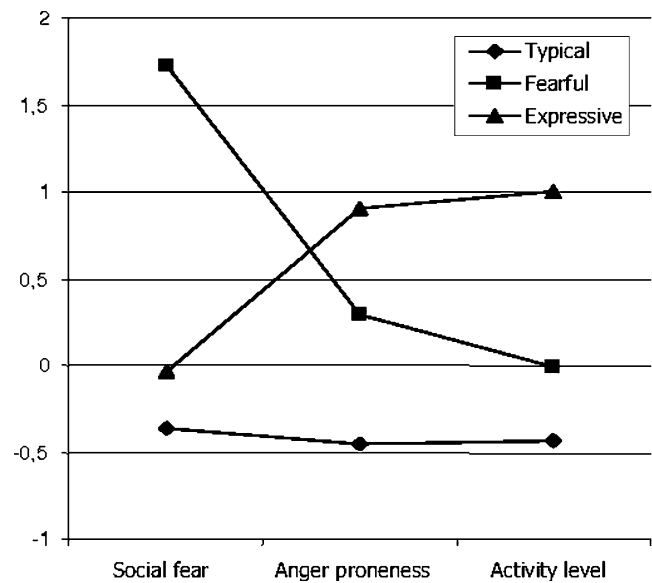


Fig. 1 Standardized means for the three temperament traits for each of the profiles in the three-profile solution

$F_{\text{social fear}}(2,381) = 177.92$, $p < 0.01$, partial $\eta^2 = 0.48$, $F_{\text{anger proneness}}(2,381) = 125.18$, $p < 0.01$, partial $\eta^2 = 0.40$, $F_{\text{activity level}}(2,381) = 156.18$, $p < 0.01$, partial $\eta^2 = 0.45$. Post-hoc Bonferroni tests indicated that all differences between profiles were significant (profile 1 vs. 2: $\Delta_{\text{social fear}} = 0.28$,

Table 1 Descriptives of the Study Variables for the Three Profiles

	N	Social fear		Anger proneness		Activity level		Internalizing problems		Externalizing problems		Negative parenting		Positive parenting	
		M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
All times															
Profile 1	224	2.36	0.66	2.65	0.60	3.53	0.62	4.29	3.84	8.33	6.00	-0.03	0.66	0.06	0.65
Profile 2	120	2.72	0.71	3.93	0.69	4.88	0.59	6.57	4.12	15.42	6.88	0.06	0.74	-0.13	0.76
Profile 3	40	4.43	0.69	3.35	0.78	3.83	0.70	8.42	4.43	11.99	5.35	0.02	1.01	-0.22	0.70
T1															
Profile 1	45	2.39	0.63	2.75	0.60	3.37	0.69	4.43	4.10	9.07	6.68	-0.18	0.54	0.06	0.58
Profile 2	37	2.60	0.72	3.99	0.67	4.83	0.51	6.93	4.11	17.82	7.04	0.10	0.90	-0.20	0.66
Profile 3	14	4.34	0.62	3.40	1.01	3.78	0.76	6.59	4.54	12.00	6.42	-0.17	0.76	-0.38	0.74
T2															
Profile 1	57	2.38	0.59	2.64	0.56	3.57	0.50	4.10	3.86	8.30	6.75	0.04	0.86	-0.04	0.76
Profile 2	26	2.89	0.71	3.88	0.71	4.99	0.50	6.91	4.50	15.77	7.12	0.07	0.64	-0.18	0.71
Profile 3	13	4.45	0.53	3.35	0.58	3.95	0.86	8.27	4.12	11.81	5.14	-0.01	0.41	-0.24	0.62
T3															
Profile 1	63	2.38	0.70	2.63	0.65	3.56	0.65	4.13	3.86	8.22	5.64	-0.01	0.58	0.05	0.70
Profile 2	28	2.61	0.58	3.88	0.60	4.94	0.64	6.05	3.11	13.36	6.22	0.12	0.84	-0.24	1.00
Profile 3	5	4.56	0.99	3.54	0.52	4.11	0.79	11.60	3.29	14.20	4.03	0.33	1.18	-0.05	0.50
T4															
Profile 1	59	2.31	0.70	2.60	0.58	3.58	0.64	4.42	3.66	7.92	5.07	-0.01	0.62	0.15	0.52
Profile 2	29	2.80	0.80	3.97	0.83	4.78	0.75	6.32	4.75	14.01	6.37	-0.06	0.48	0.12	0.63
Profile 3	8	4.48	0.84	3.09	0.76	3.51	0.55	9.89	4.41	10.87	4.85	0.20	1.85	0.03	0.89

$p < 0.01$, $\Delta_{\text{anger proneness}} = 1.15$, $p < 0.01$, $\Delta_{\text{activity level}} = 1.27$, $p < 0.01$; profile 1 vs. 3: $\Delta_{\text{social fear}} = 2.18$, $p < 0.01$, $\Delta_{\text{anger proneness}} = 0.65$, $p < 0.01$, $\Delta_{\text{activity level}} = 0.42$, $p < 0.01$; profile 2 vs. 3: $\Delta_{\text{social fear}} = 1.90$, $p < 0.01$, $\Delta_{\text{anger proneness}} = 0.51$, $p < 0.01$, $\Delta_{\text{activity level}} = 0.85$, $p < 0.01$). The majority of the sample was classified as belonging to a profile that was lower than the other two profiles on all three temperament traits. Profiles that are similar to this one have sometimes been labeled well-adjusted. However, as the temperament traits themselves were not a measure of adjustment, we did not follow this tradition, but called this profile ‘typical’. Profile 2 was characterized by the highest levels of anger proneness and activity level, and intermediate levels of social fear. We called this profile ‘expressive’, as it was both anger prone and active. The third profile was characterized by the highest levels of social fear, and intermediate levels of anger proneness and activity level, and we called it ‘fearful’. Although studies often use the term ‘inhibited’ to describe profiles that are fearful, we did not choose this label as this type was more anger prone and active than the typical group, whereas an ‘inhibited’ type is generally below average on anger proneness. At each time point, each individual was classified into the profile for which she/he had the highest probability.

We performed a MANOVA to investigate differences between profiles in levels of adjustment problems. The multivariate test revealed a significant and large main effect of temperament profile, $F(4,762) = 33.95$, $p < 0.01$, partial $\eta^2 = 0.15$. Tests of between-subjects effects revealed a significant, medium effect for internalizing problems ($F(2,381) = 25.37$, $p < 0.01$, partial $\eta^2 = 0.12$), and a significant and large effect for externalizing problems ($F(2,381) = 51.29$, $p < 0.01$, partial $\eta^2 = 0.21$). Post-Hoc Bonferroni tests indicated that the typical profile was lower on internalizing and externalizing problems than both the expressive profile ($\Delta_{\text{internalizing}} = 2.29$, $p < 0.01$; $\Delta_{\text{externalizing}} = 7.09$, $p < 0.01$), and the fearful profile ($\Delta_{\text{internalizing}} = 4.14$, $p < 0.01$; $\Delta_{\text{externalizing}} = 3.66$, $p < 0.01$). The fearful profile had higher levels of internalizing problems than the expressive profile, whereas the expressive profile had higher levels of externalizing problems than the fearful profile ($\Delta_{\text{internalizing}} = 1.85$, $p = 0.01$; $\Delta_{\text{externalizing}} = 3.43$, $p < 0.01$).

Profile Stability

General loglinear modelling was performed in SPSS, to investigate the stability of temperament classifications across time points. At each interval, staying in any of the temperament profiles was identified as a statistically significant type (a sequence that occurred more often than expected by chance). Profile stability was high: 71% of the children retained their profile membership from the first to the second time point, 68% retained their profile membership from the second to the third time point and

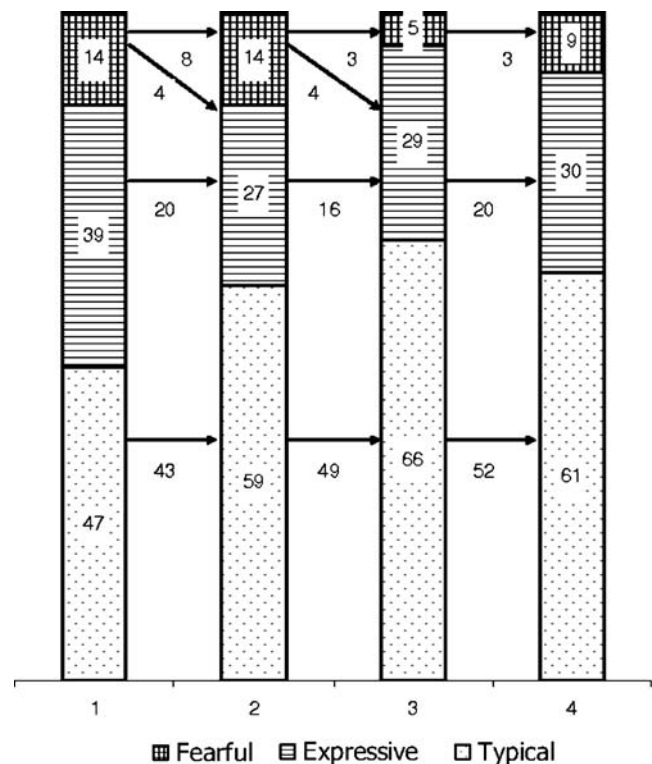


Fig. 2 Percentage of participants classified into each temperament profile at each time point. Arrows indicate pathways between time points identified as statistical types. Numbers at arrows indicate percentage of participants out of the total number in each cross-tabulation. Statistical antitypes are not shown

75% retained their membership from the third to the fourth time point. Finally, 72% of the preschoolers were classified into the same profile at the fourth as at the first time point. Certain changes were also statistical types: 4% of the children changed from ‘fearful’ to ‘expressive’ from the first to the second, and from the second to the third time point. All other changes were statistical antitypes, indicating that they occurred less often than expected by chance. The total percentages of participants who made a transition between profiles that was identified as a statistical type, are shown in Fig. 2.

Temperament Profile Probability and Parenting

To investigate relations between the temperament profiles and parenting, multivariate latent growth models were fitted, including the probability for a temperament profile and negative or positive parenting. The models provided an acceptable fit to the data (typical-positive: $\chi^2(24) = 36.85$, $p = 0.05$, CFI=0.98, GFI=0.92, RMSEA=0.08; typical-negative: $\chi^2(24) = 28.92$, $p = 0.22$, CFI=0.99, GFI=0.95, RMSEA=0.05; expressive-positive: $\chi^2(19) = 28.14$, $p = 0.08$, CFI=0.97, GFI=0.94, RMSEA=0.07; expressive-negative: $\chi^2(19) = 29.97$, $p = 0.05$, CFI=0.96, GFI=0.95, RMSEA=

0.08; fearful-positive: $\chi^2(19)=18.78$, $p=0.47$, CFI=1.00, GFI=0.96, RMSEA=0.00; fearful-negative: $\chi^2(24)=31.36$, $p=0.17$, CFI=0.98, GFI=0.94, RMSEA=0.05).

Children who were more likely to be classified as typical initially, had parents who displayed more positive parenting ($\sigma^2=0.05(0.03)$, $p<0.01$), whereas children who were more expressive or fearful had parents who displayed less positive parenting ($\sigma^2=-0.04(0.02)$, $p<0.001$; $\sigma^2=-0.04(0.02)$, $p<0.01$, respectively). Parents of children who were more fearful also displayed more negative parenting ($\sigma^2=0.06(0.03)$, $p<0.001$), whereas the typical and expressive profiles were not related to negative parenting. Initial profile probability was related to changes in parenting over time: children who were more typical had parents who displayed a less strong increase in positive parenting over time ($\sigma^2=-0.06(0.02)$, $p<0.001$), and children who were more expressive or fearful had parents who displayed a stronger increase in positive parenting over time ($\sigma^2=0.04(0.01)$, $p<0.001$; $\sigma^2=0.05(0.02)$, $p<0.001$, respectively). Initial levels of temperament profile probability were not related to changes in negative parenting over time, and initial levels of parenting were not related to changes in temperament probability over time. Finally, associated change occurred: when children became more typical, parents increased more in positive parenting ($\sigma^2=0.03(0.02)$, $p<0.001$) and decreased in negative parenting over time ($\sigma^2=-0.04(0.02)$, $p<0.01$). When children increased in expressiveness or fearfulness parents displayed a weaker increase in positive parenting ($\sigma^2=-0.02(0.01)$, $p<0.001$; $\sigma^2=-0.03(0.01)$, $p<0.001$, respectively). Change in probability for expressiveness or fearfulness was not related to change in negative parenting.

Discussion

This study investigated temperament profiles in children aged 2 to 4 years. We found a three-profile solution: a typical profile, characterized by low levels of social fear, anger proneness and activity level, an expressive profile, characterized by low levels of social fear, and high levels of anger proneness and activity level, and a fearful profile characterized by high levels of social fear, and intermediate levels of anger proneness and activity level.

Like the present study, several other studies converged on a three-profile solution. Although they investigated different temperament traits, Komsis and colleagues (2006) and Stifter and colleagues (2008) reported an undercontrolled or exuberant type that was similar to our expressive type, as well as an overcontrolled or inhibited type that was similar to our fearful type, and finally a resilient or low reactive type that was similar to our typical type. The validity of the types found in the present study is supported

by the differential relations of the types to adjustment problems. Although previous studies found one or two types with elevated internalizing as well as externalizing problems (Aksan et al. 1999; Janson and Mathiesen 2008; Rettew et al. 2008; Stifter et al. 2008), we found one type that was high on internalizing problems, the fearful type, and a different type that was high on externalizing problems, the expressive type, and finally one type that was generally well-adjusted.

Our results resemble findings in personality research, which has replicated three types across measurement, analysis method and culture: a resilient type that is well-adjusted, an overcontrolled type that is prone to internalizing problems and an undercontrolled type that is prone to externalizing problems (e.g., Asendorpf and van Aken 1999; Hart et al. 1997; Robins et al. 1996; Van Leeuwen et al. 2004). Some differences between the temperament profiles of the present study and these personality types can also be noted. The fearful and expressive types both have higher levels of fearfulness and anger proneness compared to the typical group, whereas the undercontrolled type is less fearful and the overcontrolled type is less anger prone than the resilient group. It appears that as temperament becomes differentiated into personality, the two less well-adjusted profiles become more distinct from each other. Perhaps the most salient feature of the profile becomes more strongly entrenched into the child's developing personality, magnifying differences between these profiles.

Contrasting our findings, two studies on temperament profiles found a five profile solution (Caspi and Silva 1995; Janson and Mathiesen 2008). However, three of the five profiles were highly similar across these two studies (the undercontrolled, inhibited and confident types, which are again highly similar to our three types), whereas the remaining two types differed. Perhaps some sample specific variations became significant as subtypes due to the large sample sizes of both these studies ($N=993/1,037$). It is also true that the guidelines for interpreting these results are not clear-cut, and ultimately based on the priority given to certain considerations, such as interpretability of the profiles, statistical significance of the addition of profiles, and the choice of model fit statistics (Muthén and Muthén 2000).

In addition to investigating which profiles best described the present sample, we investigated the longitudinal stability of these profiles. Although toddlerhood is a period of rapid development in several domains, temperament profile stability was high: between 68% and 75% of children retained their profile between consecutive time-points, and 72% was classified in the same profile at the first and the fourth timepoint. Aksan and colleagues (1999) and Janson and Mathiesen (2008) found a lower stability of around 50%, even across a comparable timegap (1 year, as

between the first and the fourth time point of the present study). Perhaps stability was lower in these other studies because they converged on a solution with more profiles, that were more similar to each other than the profiles in the present study. When profiles differ more, children are less likely to transition between them. Another interesting result was that it was a type to transition from fearful to expressive across the first three time points, but not from the third to the fourth time point. This pattern supports the idea that as children grow older their developmental trajectories become more crystallized, and change becomes less likely (Roberts and Delvecchio 2000). Although test-retest correlations indicate moderate stability for temperament traits at preschool age, results of the present study indicate that when three profiles are used to describe temperament, the configuration of these traits is much more stable.

Although profile stability was high, change did occur. As LPA produces probability scores for the profiles, we were able to investigate how (changes in) the probability that individuals were classified into a certain profile were related to parenting. Initial typicalness was related to more positive parenting, whereas initial expressiveness was related to less positive parenting. Initial fearfulness was related to less positive parenting and more negative parenting. Studies on temperament traits have also found negative emotionality (anger and fearfulness) to be related to more negative and less positive parenting (Bridgett et al. 2009; Paulussen-Hoogeboom et al. 2007). However, social fear or inhibition has also been found to be related to less negative parenting (Bryan and Dix 2008; Rubin et al. 2002). Perhaps social fear as a trait is related to less negative parenting across all children, because parents see these children as vulnerable and react by being especially careful. However, children belonging to the fearful profile may be especially problematic, as they also have heightened levels of anger proneness and experience more negative parenting and less positive parenting. Future research could investigate the possibility of differential relations of social fearfulness to negative and positive parenting in different temperament types.

In addition to these concurrent relations, we found over-time relations between initial levels of temperament probability and changes in parenting, such that higher initial typicalness was related to weaker increases in positive parenting over time, whereas higher initial expressiveness and fearfulness were related to stronger increases in positive parenting over time. Although these relations may seem unexpected at first glance, they should be interpreted in concert with the other relations in the models. As for instance typicalness was related to higher levels of positive parenting initially, parents of more typical children possibly could not increase as much as parents of children that started out lower.

Although conclusions regarding directionality of effects can never be definitive from these types of correlational analyses, as relations could be due to third variables such as genetic parent-offspring similarity, it is interesting that there were several relations between initial levels of child temperament and changes in parenting, but no relations between initial levels of parenting and changes in child temperament. Several studies investigating temperament traits have also uncovered these child-driven processes. In children aged 8 to 11, child irritability has been shown to predict increases in inconsistent discipline, whereas child fearfulness and positive emotionality predict increases in maternal acceptance (Lengua and Kovacs 2005). Higher initial fear has been related to decreases in rejection and consistency, whereas higher initial irritability has been related to increases in consistency over time (Lengua 2006).

Finally, increases for typicalness were related to increases in positive parenting and decreases in negative parenting, and increases in expressiveness and fearfulness were related to decreases in positive parenting. These associated changes, that were independent of initial levels, show that when either children or parents changed, the other changed accordingly. Parents and children may have experienced each other as changing and reacted to these changes, resulting in these parallel processes.

Strengths and Limitations

The present study has several strengths. First, we performed latent profile analysis, rather than cluster analysis as most studies have previously done. Second, the longitudinal design incorporating four measurements allowed us to investigate stability in profiles over time. We performed latent growth modeling, investigating both negative and positive parenting in relation to profile probability trajectories. Furthermore, we incorporated multiple informants' perspectives in our predictor variables, reducing informant bias.

Despite these strengths, some limitations are also worth mentioning. First, the use of the TBAQ as the temperament measure may have limited generalizability of the results. Although the TBAQ is brief and was designed specifically for the age range of the children in this study, the internal consistency of the scales was moderate, and we lacked a measure of effortful control. Replication of the temperament profiles across other measures, including effortful control, is necessary. Second, research on temperament and adjustment problems has been criticized by stating that the associations between traits and problem behavior result from item overlap. However, an indication that item contamination is limited comes from studies that found that the pattern of relations between temperament and adjustment was not affected after removal of the possibly

confounded items (Lemery et al. 2002; Lengua et al. 1998). Third, although observational measures were available for parenting, mothers were the sole reporters on the child's temperament and behavior problems. Reliance on a single informant may produce relations that are biased by the informant. However, multiple studies have shown that temperament and behavior problems are also related when different informants are used (e.g., Booth-LaForce and Oxford 2008; Smeeckens et al. 2007). Fourth, stability may have been inflated because mothers filled out the same questionnaire at each time point. Their memory of what they reported may influence subsequent reports. More generally, mothers may tend to retain a stable picture of their child, despite changes in the child's behavior. Although future research should include other informants, we would like to note that mothers are considered valuable informants for both temperament and behavior problems. Especially in the preschool period, mothers are usually the ones who spend most time with their children and experience their reactions in a wide range of situations. Finally, generalizability of the results may be limited as the sample consisted mainly of Dutch, middle class, 2-parent families. Replication in lower income, culturally diverse samples is needed.

Conclusion

Similar to a few other studies investigating temperament profiles, and many investigations of personality profiles, toddlers' temperament trait configurations were best described by three profiles: a typical, well-adjusted profile, an expressive profile, prone to externalizing problems and a fearful profile, prone to internalizing problems. Although temperament profile stability was high, changes in profile probability occurred. We identified negative and positive parenting as environmental mechanisms that were related to the development of temperament profiles over time.

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